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TRANSPORT OF MARBLE ON LAND OR BY RIVER IN SE-NORICUM AND WESTERN PANNONIA

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The analyses of W. W. Müller on the marbles from the quarries in today's Carinthia as well as Styria and Štajerska (Untersteiermark) combined with the investigations of B. Djurić have brought a lot of information about the marbles used in these regions in Antiquity as well as the means of transport. This contribution tries to discuss the possibilities of transport of marble from the various quarries to their final destination discerning between transport by river and transport on land.

Key words: Southeastern Noricum, Western Pannonia, Danube, quarries, costs, time, ships, transport

By the physico-chemical as well as mineralogical and petrographic analyses of H. W. Müller of the marble objects of Roman times in Carinthia[1] (fig. 1), Styria (fig. 2), Štajerska (fig. 3), especially in the territory of Poetovio[2] as well as in other parts of Pannonia[3] and in the northern part of Noricum on the Danube[4] the exploration of the origins of Roman marbles in these areas have been considerably advanced, although only a limited number of objects could be sampled, so that statistical statements appear limited[5]. B. Djuric has repeatedly dealt with the role of the marble from the Eastern Alps, especially the marble from Gummern and from the Pohorje (Bachem) in Noricum and Pannonia, and together with H. W. Müller he has presented a first synthesis on this subject[6]. Regarding the question of the quarries and the transport routes in Carinthia, the two theses of J. Feinig and of A. Steiner are important preparatory works[7]. On the basis of these works an attempt is made to tell something collectively about cities, quarries, land and water transport in the affected areas. By the considerations developed here the territories of Virunum, Teurnia, Flavia Solva and Poetovio are pri-

[1] *From the investigations of H. W. Müller have resulted the diploma-theses of* Feinig *2001 and of* Steiner *2005 as well as the contributions of* Steiner *2006,* Steiner *2007a and* Steiner *2007b.*
[2] *Djurić et al. 2004.*
[3] *Müller 2001b; Müller 2002.*
[4] *Müller et al. 2004.*
[5] *Cf.* Pochmarski *2004, 437;* Steiner *2006, 71.*
[6] *Djurić – Müller 2009.*
[7] Feinig *2001;* Steiner *2005.*

Fig. 1: Marble quarries in Carinthia: map by M. Pochmarski-Nagele, following Google earth.

marily affected and marginally also Savaria and Scarbantia (fig.4).

Of those quarries known to us, which have at least been partly used in ancient times, in Carinthia only the quarry of Gummern[8] near Villach was of supraregional and even inter-provincial importance[9]. For Virunum marble from Gummern does not only make up about half (51%) of the pieces sampled by H. W. Müller[10] and for Teurnia even 88%[11], but was also transported to other city territories, thus to Flavia Solva, where the proportion of marble from Gummern amounts about 11%, in the immediate city area of Flavia Solva even about 15%[12]. But the marble of Gummern also reached the cities of the neighbouring province of Pannonia, which are of interest for this study; to Poetovio, where - due to the small number of sampling – the not very representative percentage is 15%[13], but probably also to Savaria[14] - there are however not yet any results of investigations[15] - and to Scarbantia, for which there exist only unpublished investigations[16] and analyses of a few sampled pieces[17]. In addition, in the opinion of B. Djuric and H. W. Müller the marble from Gummern was also transported to more distant cities such as Pannonian Mursa and Sirmium: they also mention percentages - 62.5% and 52% in Mursa respectively in Sirmium, but without evidence of these numbers[18]. There is a serious issue regarding their own statement that it is very difficult to distinguish the two main marbles form the Eastern Alps – the marble from Gummern and that from the Pohorje (Bachem)[19]. H. W. Müller has further modified the spreading of the marble from Gummern[20]: he names Aquincum on the Danube, of which five (!) specimens were analyzed by him[21], Carnuntum, for which there is no study to my knowledge, and furthermore the places Tulln, Lauriacum, Lentia, for which there are partly sampled stone monuments by the investigations running from Passau to Zeiselmauer on the Norican Limes; however in the results of these investigations Tulln is not represented, whereas Lauriacum is very well represented[22]. H. W. Müller also names the cities of Ovilava, Iuvavum and Brigantium[23], for which no evidence is known to me, nor does he indicate any.

In contrast to the marble from Gummern the other quarries in Carinthia, in Kraig, Tentschach, Tiffen, Töschling, Spitzelofen had only local and some regional significance for Virunum, where 29% of the sampled pieces were made of marble from Kraig, 9% of marble from Tentschach and 5,5% of marble from Spitzelofen[24]; but also to Teurnia, where small amounts of marble from Spitzelofen (4% of the sampled specimens) and also marbles from Kraig, Tentschach, Töschling or Tiffen (2.5% of the studied pieces) were delivered[25]. However, H. W. Müller speaks about marbles from Kraig in connection with the few pieces he analyzed from Aquincum, Scarbantia and the Burgenland but it concerns only a single piece in the Museum in Eisenstadt[26].

For Styria and its *municipium* Flavia Solva the investigations of H. W. Müller have shown that in the entire city territory of 144 sampled monuments - from Flavia Solva itself, but also from Eastern and Western Styria and from the environs of Graz[27] - about half (48.6%) come from the Pohorje (Bachem). In contrast, the Kainach marble represents only 40% of the sampled items throughout the city territory, and the percentage of 80% is very high above all only in Western Styria,

[8] Feinig 2001, 34-35; Steiner 2005, pp. 78-79.
[9] Steiner 2005, p. 95; Müller 2007, p. 35.
[10] Steiner 2006, pp. 71-73 figs. 13. 16. 19.
[11] Steiner 2006, pp.71-73 figs. 14. 17. 20.
[12] Djurić et al. 2004, pp. 414-418 figs. 31-35.
[13] Djurić et al. 2004, pp. 409-411 fig. 36; cf. Djurić 2005, pp. 77-80.
[14] Djurić – Müller 2009, p. 116.
[15] Djurić – Müller 2009, p. 116 n. 17 have erroneously pointed out to Müller 2001b, pp. 245-254, because the pieces sampled there in Veszprém, Keszthelyi, Zalalövö and Zalaegerszeg in any case do not come from the territory of Savaria.
[16] Djurić – Müller 2009, p. 116 n. 19 refer to still unpublished analyses of H. W. Müller.
[17] Müller 2002, pp. 767-769.
[18] The quotation in Djurić – Müller 2009, p. 116 n. 21 refers to Djurić 2005, pp. 75-82, where however no reference to the numbers quoted can be found.
[19] Djurić – Müller 2009, p. 113; cf. Djurić et al. 2004, p. 409; Djurić 2005, pp. 75-77.
[20] Müller 2007, p. 35.
[21] Müller 2002, pp. 767-769.
[22] Traxler 2007, pp. 79-83. 90-105.
[23] Müller 2007, p. 35.
[24] Steiner 2005, p. 95; Steiner 2006, p. 68.
[25] Steiner 2006, p. 71 fig. 14.
[26] Müller 2002, pp. 768-769: LM 19.
[27] Djurić et al. 2004, figs. 31-35.

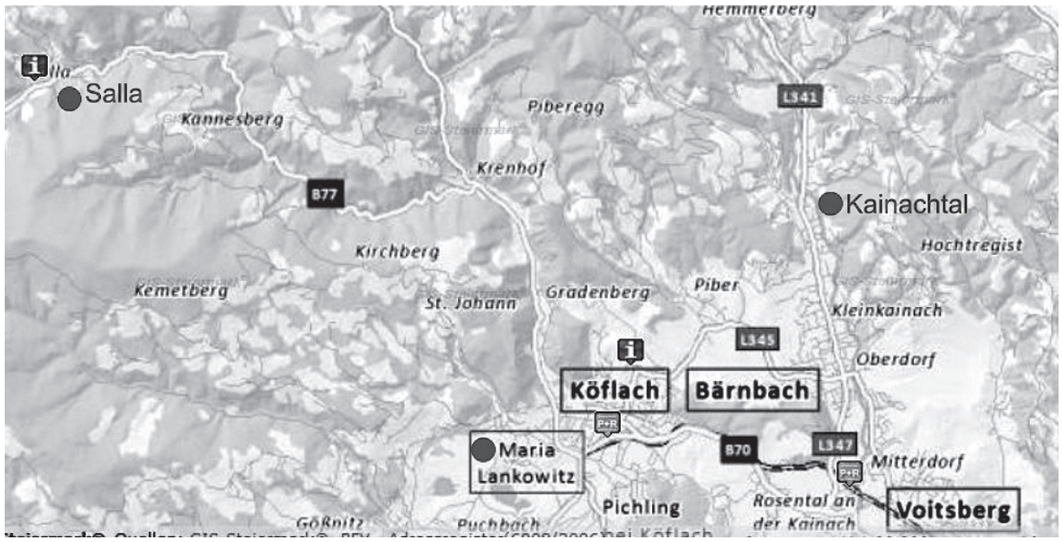

Fig. 2: Marble quarries in the northern part of Western Styria: map by M. Pochmarski-Nagele, following GIS Styria

Fig. 3: Marble quarries in Štajerska: map by M. Pochmarski-Nagele, following Google earth.

while in the actual city of Flavia Solva the marble from Kainach as the marble from Gummern counts only about 15 %.

For Poetovio the investigations of H. W. Müller have showed that of the sampled specimens there - primarily grave stelai, sarcophagi and urns[28] – there are about 84% of Pohorje marble and the remaining 16% of marble from Gummern[29]. According to the considerations of B. Djuric and H. W. Müller the marble of Pohorje (Bachern) would also prevail in Savaria, but in addition there would also occure marble from Gummern and from Kainach[30]; for Scarbantia it would be also possible to demonstrate that beside the marble from Gummern also marble from Pohorje (Bachern) was present[31]. Finally, the two authors also stated that in Mursa 37,5% and in Sirmium 48% of the marble objects were made of Pohorje marble[32].

Before discussing the specific transportation means in the Southeast of Noricum and western Pannonia, a couple of general comments on the transport of marble in the Roman period must be made (fig. 4). Basically, the inland waterway transport was preferred to the transport on land because of the possibility of larger transport volumes and the higher speed[33]. As inland

[28] Djurić *et al. 2004, pp. 404-408.*
[29] Djurić *et al. 2004, fig. 36.*
[30] Djurić – Müller *2009, p. 116 n. 17; the contribution of* Müller *2001b, pp. 245-254 cited there does not refer to pieces found in the territory of Savaria: cf. supra n. 15.*
[31] Djurić – Müller *2009, p. 116 n. 19: this note refers however to not yet published researches of H. W. Müller; cf. supra n. 16.*
[32] Djurić – Müller *2009, p. 116 n. 21: the contribution of* Djurić *2005, pp. 75-82 cited here, does not refer in any way to the mentioned numbers: cf supra n. 18.*
[33] *Cf.* Eckoldt *1986, p. 203;* Schneider *1992, p. 150;* Djurić *1997, pp. 75. 79-80;* Müller *2002, p. 767;* Djurić *2004, p. 163;* Hemmers – Traxler *2004, pp. 160-161;* Müller *et al. 2004, p. 79;* Djurić *2005, p. 76;* Steiner *2005, p. 100;* Müller *2007, p. 35;* Djurić – Müller *2009, pp. 114-115.*

Fig. 4: Cities of Noricum, Pannonia and Regio X: map by M. Pochmarski-Nagele, following Großer Historischer Weltatlas [6](München 1978) Taf. 30.

waterways not only the big rivers like the Danube, the Rhine and the Rhône, but certainly also smaller rivers such as the Mosel, the Inn, the Sava, the Drava (Drau) and the Mur (Mura) were used[34]. About the ship types used for the heavy transport in Noricum and Pannonia we are only very incompletely informed. Therefore we have to rely on visual representations and archaeological finds from the Rhine and the Gaulish provinces or from Rome.

The situation on the Rhine can be explained by a relief from Mainz[35] and one from Cologne[36] which show a seemingly Mediterranean-influenced type of ship with a flat cargo floor and pulled up astern[37]. The crew on the relief from Mainz is formed by a helmsman at the central control in the rear, a second mate with a side rudder in the bow and four rowers - two on each side -; in the front of the ship there is a low mast for towing, which the rowers at the ascent can use for towing[38]. Similarly, on the Cologne fragmentary relief the flat bottom and the raised stern can be seen, besides the helmsman and four or five rowers[39]. These barges with the rowers are suitable for use on larger rivers. They represent the type of the so-called prahm (barge) in a slightly modified form[40].

Riverboats in pre-Roman Celtic[41] or originally Illyrian tradition[42] are found again in the type of the prahm (barge), which is characterized by a flat bottom, without a keel and without stem or stern; bow and rear are formed as flat ramps. These ramp barges originally developed from dugouts, which were halved by the length and enlarged by intervening bottom and side planks[43]. With these box-shaped barges no oars were found.

However equivalents of the *caudicaria* characteristic for the Tiber, which is curved with a rounded hull and keel and has a strongly curved tail and a long extended nose have not been found north of the Alps[44]. The proposition of W. Böcking equating *caudicaria* with prahm (barge) has hardly been appreciated[45]. The capacity of a barge might have amounted to a maximum of 30 tons[46]; but according to W. Boppert the relief of the *nauta* Blussus which shows a ship called by her a prahm (barge) has a stress loading capacity of about 7 tons[47], and also Ch. Hemmers and St. Traxler are of the opinion that for smaller rivers like the River Drava (Drau) vessels with a smaller cargo capacity were used[48]. On one of the base reliefs on the N-side of the tomb of the Secundinii in Igel[49] a scene is shown, in which two "treidelknechte" draw a boat which is loaded with two bales of goods and

[34] *Cf. Eckoldt 1980, pp. 11-20; Höckmann 1985, p. 136; Eckoldt 1986, p. 203; Hemmers – Traxler 2004, p. 152.*
[35] *Boppert 1992, pp. 53-59 pl. 6. 7.*
[36] *Neu 1982, pp. 133-138 pl. 9,2; Neu 1989, pp. 324-247 no. 43 figs. 136-140.*
[37] *Höckmann 1985 ,p. 139.*
[38] *Frenz 1982, pp. 80-81.*
[39] *Neu 1982, pp. 133-134.*
[40] *Höckmann 1994, p. 433; Boppert 1994, p. 414.*
[41] *Höckmann 1985, p. 139.*
[42] *Höckmann 1995, pp. 87-88.*
[43] *Höckmann 1985, pp. 139-140.*
[44] *Höckmann 1994, p. 433; Boppert 1994, p. 414.*
[45] *Böcking 1996, p. 209.*
[46] *Eckoldt 1986, p. 203; Höckmann 2000, p. 267; Hemmers – Traxler 2004, p. 160.*
[47] *Boppert 1992, p. 58.*
[48] *Hemmers – Traxler 2004, p. 161.*
[49] *Dragendorff – Krüger 1924, pl. 16.3; Frenz 1982, p. 82 fig. 3; Höckmann 1985, p. 137 fig.113.*

is steered by a third man with the rudder or a paddle; the boat will may well be described as a prahm (barge). Researchers take unanimously the view that sailing was hardly used on inland waterways[50]; for rowing smaller rivers were too narrow; besides there is the fact that the rivers are likely to have had strong meanders[51]. The movement upstream was done by poling or using single paddles[52], but especially by towing[53]; pulling the boat by ropes with the exception of the route Ostia – Rome, was exclusively done by people[54]. As far as the sea transport is concerned are canoes are the primarily used and simplest form[55]. The load carrying capacity of a dugout fluctuated between 0.2 to 1 tons[56].

The road transport was characterized by high costs and low speed, because it was dominated by the slow oxen-drawn carts[57]. Basically, the work-pieces had to be brought first from the quarries to driveways and afterwards to construction sites or workshops[58]. The taking down of the marble from the quarries was performed on coarsely made dragging paths the blocks being lowered on wheels or on wooden sleds[59]. In recent times especially B. Djuric has dealt with the terms of the transport from the stone quarries on Pohorje (Bachern)[60]. He assumes that the marble from the Pohorje Mountains, where besides Šmartno na Pohorju (St. Martin am Bachern) there were also many small quarries, was transported through the valley of the Velika Polskava to the plain. The *via publica* from Celeia to Poetovio was reached in the area of the hill of Velenik[61]. There was probably a workshop (*officina*) or even several of them, where the blocks were processed into semi-finished products; at least traces of a settlement with raw marble blocks and mounds were found in this area[62]. From here the transport was by road to Poetovio and partly probably to Flavia Solva. As far as land transport is concerned, it can be assumed that there were ox-carts drawn by two oxen, which could move approximately 2.1 tons[63]; also in recent times the load-carrying capacity of an oxcart did not exceed 2.5 to 3 tons[64]. Due to the inscription IG II^2 1673 about the transport of column drums from Pentelikon to Eleusis the results of the research are quite unconventional[65]. W. Müller-Wiener and following him J. Feinig believed that for the transport of drums of columns, each weighing 5 to 6 tons, 27 or 40 pairs of oxen were used[66]. There is simply the misconception that 27 or 40 ox-wagons were used, each with two oxen. Regarding the weight is must be said, however, that an ox-cart would not have been able to carry a weight of 5-6 tons.

J. Feinig and A. Steiner have already given careful considerations on the issue of transportation on land or water for the Carinthian quarries (fig. 1), which in some places require a correction[67]. For the quarries in Carinthia with only local or low regional importance of Kraig, Tentschach, Tiffen, Töschling, Spitzelofen which primarily supplied Virunum and only to a small amount also Teurnia, the following can be said. For Kraig on the northern edge of the Zollfeld near St. Veit a. d. Glan, the land transport to Virunum can be assumed[68]. The assumption of A. Steiner of a connection to Völkermarkt by land, to reach the Drava (Drau) River and to get downriver to Lavamünd or upriver to Teurnia[69] is rather unlikely, since one could easily get from Virunum to the Drava River by land on the road to the Loibl-Pass near Ferlach south of Klagenfurt. Also the marble from the quarry of Tentschach north-west of Klagenfurt was brought to Virunum by land[70] and from there probably to the Drava (Drau) River at Ferlach[71]. For the two quarries of Tiffen[72] and Töschling[73] J. Feinig and A. Steiner have emphasized the position on the Roman road on the north shore of Lake Ossiach from Villach to Feldkirchen and on the north shore of Lake Wörthersee on the so-called Norican main road from Villach to Virunum. In both cases at least a partial boat service on the two lakes in the direction of Villach must be assumed[74]. The quarry of Spitzelofen[75] east of St. Georgen i. Lavanttal on the western slope of the Koralpe could deliver its marble down the River Lavant to the confluence with the Drava (Drau) at Lavamünd and from there up or down the River Drava (Drau)[76]. The quarry of Gummern[77] northwest of Villach lies on the road from Villach to Teurnia as well as to Virunum but, what is more important, it is right on the River Drava (Drau). J. Feinig wanted to assume that the transportation of marble to Teurnia was done by land, because the transport on the Drava (Drau) upstream would have involved more effort[78]. However, this is to be rejected. Indeed transportation upriver on barges was hardly any faster than that on ox-carts – Ch. Hemmers and St. Traxler believe that one should expect the same speed for towing as for oxen on land[79] - but on river one could transport far more material - instead of 2.1 tons on an ox cart up to 7 tons and more, but the maximum of almost 30 tons was hardly reached. For transport to Virunum the River Drava (Drau) could be used, in which again the reloading on ox-carts for the road to Virunum took place at Ferlach. The marble from Gummern was transported downstream the

[50] *Eckoldt 1980, p. 21; Schneider 1992, p. 150.*
[51] *Eckoldt 1980, p. 23.*
[52] *Schneider 1992, p. 150.*
[53] *Casson 1965, pp. 33-38; Eckoldt 1980, p. 24; Frenz 1982, pp. 80-85; Schneider 1992, p. 150; Höckmann 1994, pp. 428. 432; Böcking 1996, p. 212; Steiner 2005, p. 101.*
[54] *Eckoldt 1980, p. 25; Höckmann 1994, p. 432; Steiner 2005, p. 101.*
[55] *Eckoldt 1980, p. 20; Höckmann 1985, p. 136; Eckoldt 1986, p. 203.*
[56] *Eckoldt 1980, p. 20; Eckoldt 1986, p. 203.*
[57] *White 1984, pp. 131. 140.*
[58] *Cf. Müller-Wiener 1988, p. 44.*
[59] *Müller-Wiener 1988, 44; Feinig 2001, 20.*
[60] *Djurić 2001, pp. 62-63; Djurić 2004, pp. 159-161; Djurić u. a. 2004, p. 409; Djurić 2009, p. 115.*
[61] *Djurić et al. 2004, p. 409.*
[62] *Djurić 2001, pp. 62-63; Djurić 2004, pp. 159-161.*
[63] *Hemmers – Traxler 2004, p. 159.*
[64] *Ochsenwagen aus 1905 in Deutsch - Südwestafrika: http://wiki-de.genealogy.net/Ochsenwagen.*
[65] *White 1984, p. 132; Müller-Wiener 1988, p. 44; Feinig 2001, p. 20; Hemmers – Traxler 2004, pp. 153-154.*
[66] *Müller-Wiener 1988, p. 44; Feinig 2001, p. 20.*
[67] *Feinig 2001, pp. 30-38; Steiner 2005, pp. 100-106.*
[68] *Feinig 2001, pp. 35-36; Steiner 2005, p. 105.*
[69] *Steiner 2005, p. 105.*
[70] *Feinig 2001, p. 37; Steiner 2005, p. 83.*
[71] *Cf. Feinig 2001, pp. 33-34.*
[72] *Feinig 2001, p. 37; Steiner 2005, pp. 84-85.*
[73] *Feinig 2001, pp. 37-38; Steiner 2005, pp. 85-86.*
[74] *Cf. DNP 2 (1997) p. 680 s. v. Binnenschiffahrt (O. Höckmann).*
[75] *Feinig 2001, p. 36; Steiner 2005, pp. 81-82.*
[76] *In Teurnia of the material which has been sampled the proportion of marble from Spitzelofen amounts to 4%, which is more than the proportion of marble from Kraig, Tentschach, Töschling / Tiffen, which is 2% each: cf. Steiner 2006, p. 71 fig.14.*
[77] *Feinig 2001, pp. 34-35; Steiner 2005, pp. 78-79.*
[78] *Feinig 2001, p. 34.*
[79] *Hemmers – Traxler 2004, p. 154; cf. Kolb 2000, pp. 319-320.*

Drava on barges, passing Lavamünd, Maribor (Marburg) to Poetovio or farther to Mursa and Sirmium or upriver to Aquincum.

For the *municipia* of Flavia Solva and Poetovio, but also for Celeia the marble from the Pohorje (Bachern) was the most important (fig. 3). According to the studies of B. Djurić[80] this marble was brought from the complex Šmartno na Pohorju (St. Martin am Bachern) to the *via publica* Celeia - Poetovio or from the complex Hudinja overland to Celeia[81]. The further transport of material from the SE-foot of the Pohorje to Poetovio was either entirely by land or by land as far as Maribor (Marburg) and continued from there by boat to Poetovio on the Darva (Drau) River. At Maribor (Marburg) the Drava River could also be crossed on a road and thus Spielfeld at the Mur (Mura) could be reached[82]. From there the transport of the Pohorje marble to Flavia Solva could take place on the river or on the road, the River Mur (Mura) being certainly preferred. The marble from Gummern on its way to Flavia Solva could be transported downstream to Maribor too, where it was loaded onto ox carts and from Spielfeld onwards it could be moved on the Mur (Mura) or on the road. The opinion which was repeatedly expressed by B. Djurić[83] that the marble was transported on the Drava (Drau) to Poetovio and afterwards to the confluence of the Drava (Drau) and Mur (Mura) in Donja Dubrava in Croatia, only to be towed back upstream on the River Mur (Mura), cannot be maintained. Similarly, one will have to proceed cautiously as far as the question of the transport of marble from the quarries in the northern West Styria, from Salla and Kainach is concerned[84] (fig. 2). While in the case of the marble of Salla only transportation on the road to the upper valley of the Mur (Mura) seems possible, it has been thought that the marble from Kainach could have been transported down the River Kainach until it flows into the Mur (Mura) at Wildon south of Graz from where further transport upstream or downstream could be managed. The opinion which is held by H. W. Müller quite emphatically[85] that the preference must be given to the transport by water even in the case of long detours - such as Drava (Drau) River downstream until it flows into the Danube and then the Danube upstream to Aquincum and finally as far as Lauriacum - must be treated with great caution. For the Pohorje (Bachern) marble and the marble from Gummern it may be assumed that transport on the River Mur (Mura) could be continued from Flavia Solva upriver to St. Michael i. d. Obersteiermark. The question is whether the Liesing - Palten valley was still navigable until the Enns, through which the Danube could be reached.

[80] *Djurić 2001, p. 63; Djurić 2004, pp. 159-161; Djurić et al. 2004, p. 409.*
[81] *Djurić et al. 2004, p. 409.*
[82] *Djurić et al. 2004, p. 409.*
[83] *Djurić 2004, p. 163; Djurić et al. 2004, p. 409; Djurić 2005, p. 76.*
[84] *Djurić u. a. 2004, pp. 369-370.*
[85] *Müller 2002, p. 767; Müller 2007, p. 35.*

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SAŽETAK

PRIJEVOZ MRAMORA KOPNOM ILIRIJEKAMA U NORIKU I ZAPADNOJ PANONIJI

Erwin POCHMARSKI

Istraživanjima H. Mullera i ostalih provedenih na mramoru s lokaliteta Virunum, Flavia Solva, Celeia u Noriku i Poetoviju u zapadnoj Panoniji razjašnjeno je da je mramor iz Gummerna na Pohorju i ostalih kamenoloma bio prevežen rijekama, osobito rijekom Dravom, uzvodno i nizvodno, do odredišta. Tako su municipiji *Flavia Solva*, *Poetovio* i *Celeia* velikim dijelom upotrebljavali mramor s Pohorja koji je većim dijelom bio prevožen brodovima.